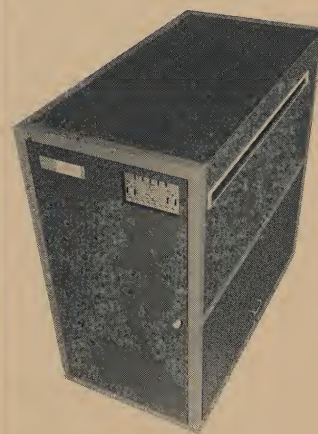


DP-203
DIGITAL
CRT PLOTTER





HOW IT BEGAN

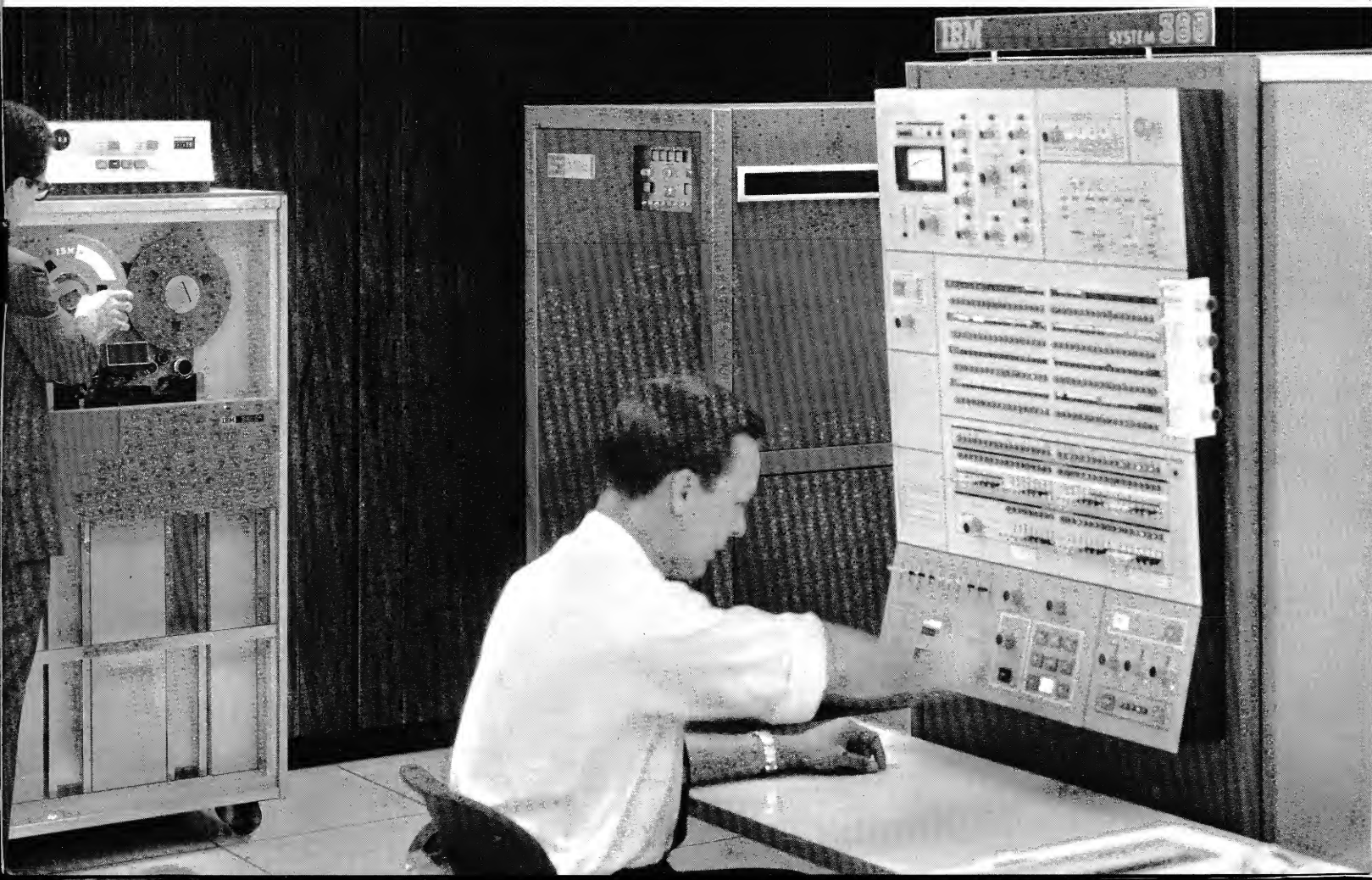
Geo Space Corporation offered its first cathode ray tube (CRT) plotter for sale in early 1964. This plotter was developed to eliminate many of the disadvantages of galvanometer and pen type plotters. Users had commented that these type plotters were difficult to calibrate, unstable, inflexible and frequency limited. Geo Space had many years experience in building analog plotters and knew of these limitations.

Geo Space analog CRT plotters are now being used worldwide and more are being delivered every month. The specific application is display of the subsurface strata formation obtained from geophysical exploration of the earth. Geo Space Corporation is a major producer of both analog and digital seismic exploration field recording and data processing instrumentation. From tiny moving coil seismometers ("geophones") to field digital and analog amplifiers and recorders, and finally, digital and analog data processing equipment.

In early 1964, an engineering group within Geo Space began the design of a digital CRT plotter using the proven drive electronics for the precisely surface speed controlled drum, which carried the photographic recording media. A breadboard IBM 1620 Model 2 computer interface was designed. By the end of 1964, the prototype DP-203 plotter was plotting on-line with an IBM 1620 disc-equipped computer system.

Immediate design began on the interface for the third generation IBM System/360 computer system interface. March of 1966 saw the commencement of on-line plotting with an IBM System/360 Model 40 computer system in Houston. Initial ALPACA® System/360 linkage software was specified, debugged and operable under System/360 8K BOS.

®ALPACA is a registered trademark of Geo Space Corporation



HOW THE DP-203 OPERATES

Plotting Format — Figure A

The DP-203 is a constant speed drum type plotter using a cathode ray tube light source to expose photosensitive paper or film attached to the drum. The spot format on the face of the CRT, and hence the projection on the surface of the drum, is a single line of 400 dots in 4 inches. A second resolution of 400 dots in two inches is provided for highly accurate image production. Recording media is attached to the drum in single sheet, light-tight Plot-O-Mag[®] film cartridges, that are rolled on and off the drum automatically. This allows day-light machine room loading and unloading of the plotter.

An X-Y coordinate plot, with maximum boundaries of 60 by 40 inches, can be produced on the plotter. Plotting is done in 4 inch wide strips around the drum. An accurate "drum index" starts the strip and termination of data transfer from the I/O Channel ends it. Under program control the CRT Optical Head can step in either direction.

System Operation — Figure B

The DP-203B is used for graphic output on the IBM System/360 computer system. Similar configuration and operations are required on other computing systems.

Through the use of the ALPACA plotting program, user provided coordinate data and the resident operating system, a binary dot image is generated in the CPU working area in core and stored on-line on the image storage disc. The disc location of any bit is directly related to a dot position on the drum of the plotter. After the complete image has been generated the plotter receives the data by requesting data serially and synchronously from the disc, through CPU core. Core may be used to alternately load in and plot out two sections, or as a single "wrap around" buffer.

Data Word Format — Figure C

The Geo Space plotter interprets a System/360 half word (2 8-bit bytes) as follows:

COMMAND CODE — A "one" in any of the modifier bit positions shown causes the various occurrences in the plotter.

FIRST BYTE — The five least significant bits (3-7) are binary weighted to designate 32 levels of intensity. The intensity is related to the plotted dots according to the state of bit #2 ("black bit") as shown in the "Binary Image Format," Figure D.

SECOND BYTE — The eight bits correspond on a 1:1 basis to dot positions on the surface of the drum.

Binary Image Format — Figure D

Depending on the state of the "black bit" (bit #2 in the intensity byte), the intensity information can produce two types of plotted images. The lefthand illustration in Figure D is produced when the "black bit" is a "zero" and the righthand illustration when it is a "one."

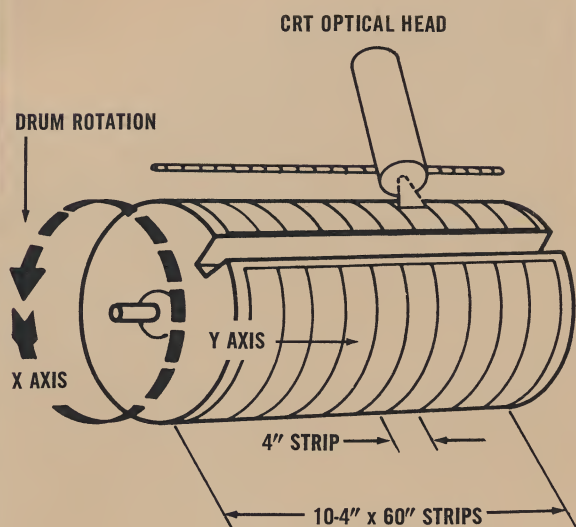
In the lefthand illustration of Figure D, the intensity information applies to the dots which are represented by "one's" in the "data" byte, and the "zeros" are blanked (level 0).

In the righthand illustration of Figure D, the intensity information applies to the "zero" dots and the "one" dots are produced at maximum intensity (black). In this case, therefore, the background is at the programmed intensity level.

[®]Plot-O-Mag is a registered trademark of Geo Space Corporation

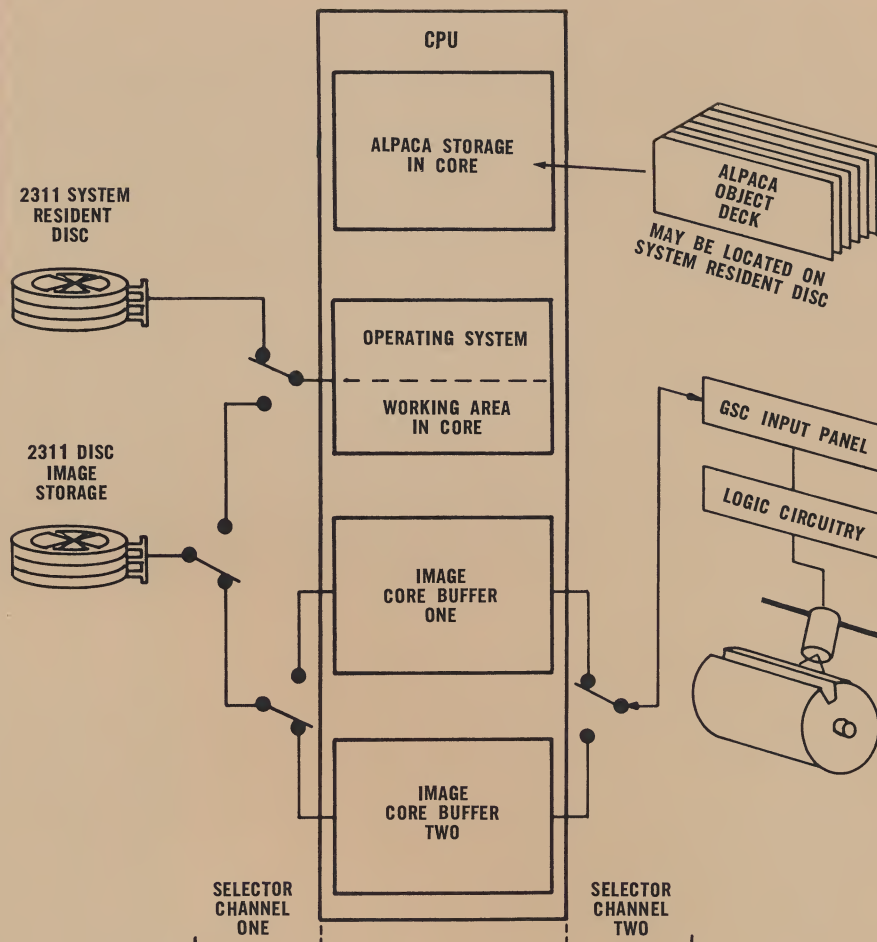


A



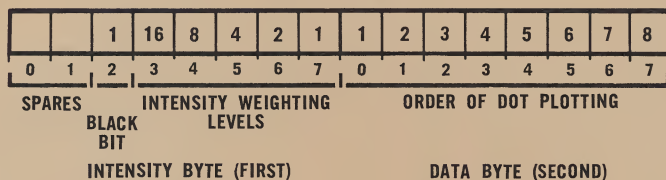
DRUM REVOLUTION = 7.5 SECS
 CAMERA STEP (INDEX) = 1.5 SECS
 PLOTTING TIME (4 X 60") = 6.0 SECS
 10-4 X 60 STRIPS (10 REVS.) = 75 SECS
 75 SEC. TOTAL PLOT TIME IS DATA INDEPENDENT

B*



C*

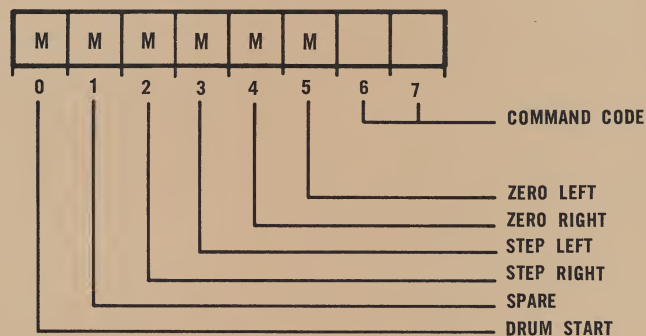
DP-203B DATA WORD FORMAT



DATA TRANSFER UNIT

Four inch strip Average = 400K bits per second. Intensity control data must be alternated with groups of data bits.

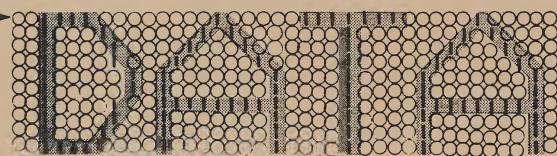
DP-203B COMMAND WORD



D

SWEEP OF CRT

"BLACK BIT" OFF



ONE DATA
BYTE

DOT INTENSITY = 16 (50% GREY)
 BACKGROUND = WHITE

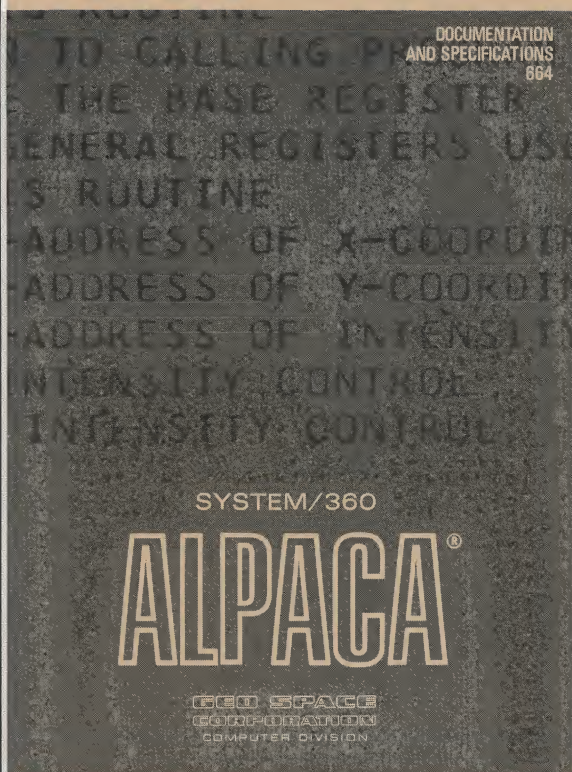
"BLACK BIT" ON



DOT INTENSITY = BLACK
 BACKGROUND = 16 (50% GREY)

* Variations of these concepts are used for on-line operations with other computer systems.

SOFTWARE



The ALPACA software package provides a linkage set of programming subroutines between the application programmer and the Geo Space DP-203 Digital CRT Plotter. The ALPACA software package consists of a set of FORTRAN IV callable subroutines which allow the programmer to generate a binary image of the desired plot, store this image on an on-line mass storage disc or drum, and then retrieve and transfer this image for plotting.

ALPACA subroutines are written in FORTRAN IV (E level) and assembly language. All I/O is in assembly language for maximum efficiency. The ALPACA subroutines are designed in such a way that the programmer is concerned only with the characteristics of the plot to be generated. By a series of FORTRAN IV calls to PLOT, the program generates a binary image of the desired plot. After the image generation is completed, the plot is made by transferring the image from the disc to the Plotter by use of the FNPLT subroutine.

With the advanced plotting capabilities of the DP-203 Plotter, ALPACA software provides the programmer with unusual capabilities for generating graphical displays. Among the extended plotting techniques available are variable width lines, variable intensity control and a character and symbol set of up to 256 different alphanumeric characters and symbols. The calls to PLOT are made with reference to the X-Y coordinate system used to generate the information to be plotted.

System 360/ALPACA

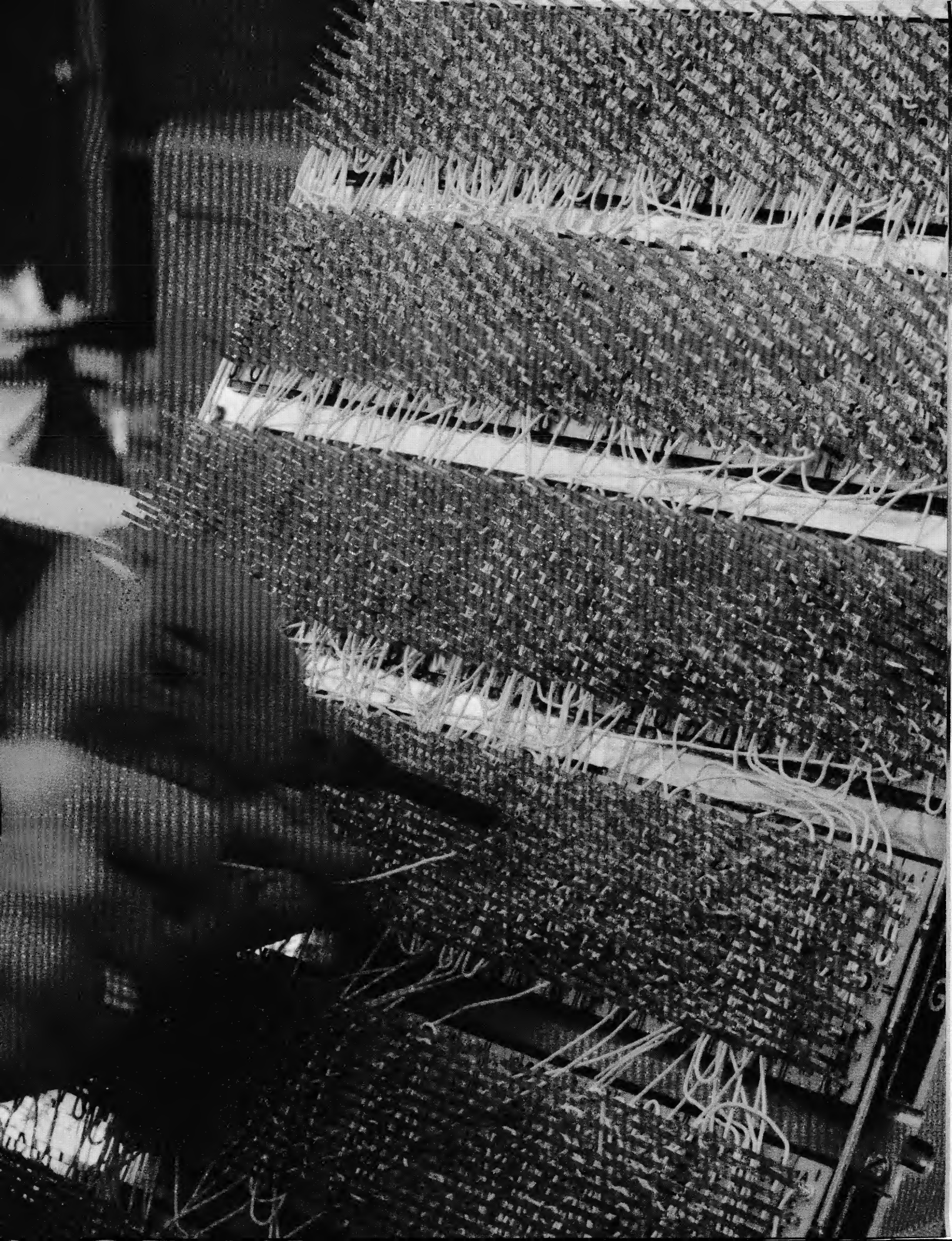
Versions of ALPACA are operable under 16 K DOS and System 360/Operating System.

Plotter Program Compatibility

Users of conventional pen type plotters can couple their existing plotter programs through ALPACA. Therefore, the user's plotting operations need not be interrupted due to converting to a more sophisticated plotter.

Hardcopy Output for CRT Displays

Additions to ALPACA are available for integration of the DP-203 into systems using display oscilloscopes, such as the IBM 2250, to plot the displays for hardcopy output. Display panels for light pen control of plotting completes the total man/machine interaction.



APPLICATIONS

Drafting

Produce structural, engineering and electronic schematic line illustrations up to 40 x 60 inch overall size. Title block, annotations and dimensions produced at one time. Variable intensity feature of DP-203 can be advantageously used to provide tonal image contrast. Film positive developed plots can be used for direct offset plate production.

Geo Space is currently writing and debugging a *drafting* language application program to optimize the use of the DP-203 for computer drafting applications.

Mapping

Contour, topographic, weather and projection cartographic maps can be easily produced on the DP-203 Plotter. Variable intensity feature can be employed for sector background shading behind a black outline field. Annotations can be positioned anywhere and any size upon the overall plotting surface of 40 x 60 inches.

General mapping image generation (on a disc or drum) can be easily produced using furnished ALPACA software. However, some types of mapping, using the DP-203, can become more efficient if the user optimizes certain *plot* routines in ALPACA to fit his specific needs. The Geo Space programming staff is available to assist you in the optimizing of ALPACA to fit your specific plotting requirements.

Time Series / Seismic Cross Sections

Geophysical exploration companies and oil industry geophysical departments can benefit from the on-line plotting capability of the Geo Space DP-203 Plotter. As the digital seismic trace data is processed by the computer, the traces can be stored on an on-line disc or drum storage medium. "Wiggle trace," variable area (VA) and variable density (VD) or a combination of these modes can be easily plotted on the DP-203. Up to six-second records can be displayed on the 40 x 60 inch recording media.

Analog wave form time series are almost identical to seismic cross section displays and can be plotted by the DP-203. Timing lines can be solid, dotted, dashed, single or N-width lines — line intensities of black or one of 32 levels of grey are available under program control.

Integrated Circuit Masks / PC Card Masters

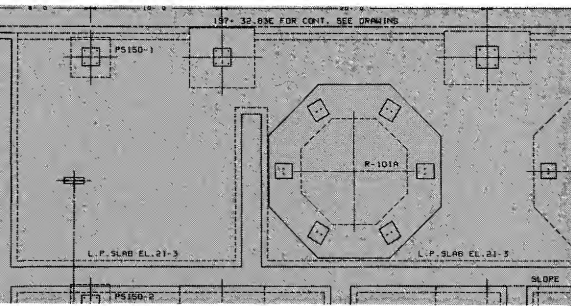
Semiconductor manufacturers can utilize the DP-203 Plotter for volume production, exact registration integrated circuit or discrete semiconductor device masks. Step-and-repeat operations optional under program control. Oxide, isolation and window diffusion, metallization, etc., masks can be produced up to a 40 x 60 inch maximum mask size. New large scale integration (LSI) integrated circuit masks are merely progressive extensions of normal plotted images.

Printed Circuit multiple images can be generated on one 40 x 60 inch film master. A PC card manufacturer can work directly from the DP-203 film image.

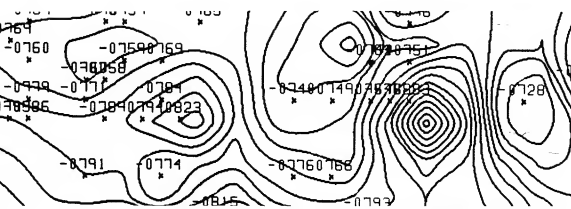
Automated Document Production

Up to twenty 8½ x 11 inch documents can be captured on one 40 x 60 inch Plot-O-Mag film sheet. ALPACA's character set produces computer line printer quality alphamerics and symbols in any height from .060 of an inch up. At a fixed height, characters can be generated very rapidly and stored on the on-line disc or drum storage system. Line drawings can also be placed on the page makeup.

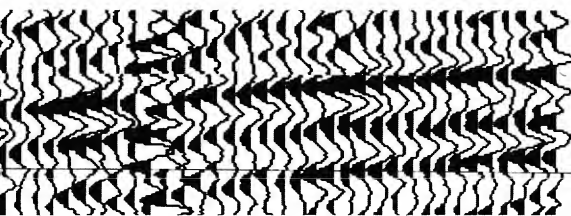
Film images can be used to directly expose offset plates up to and including 20 page signatures. Catalogs, parts listings and heavy narrative copy can be economically and very rapidly produced on the DP-203.



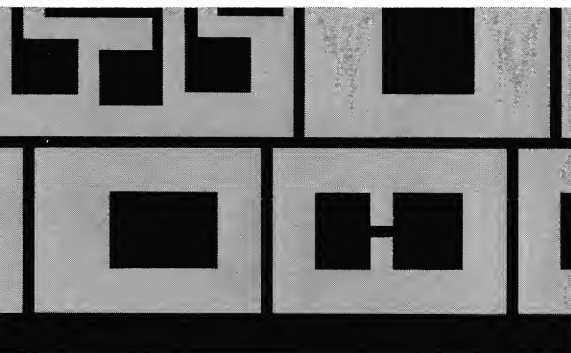
Section of construction drawing



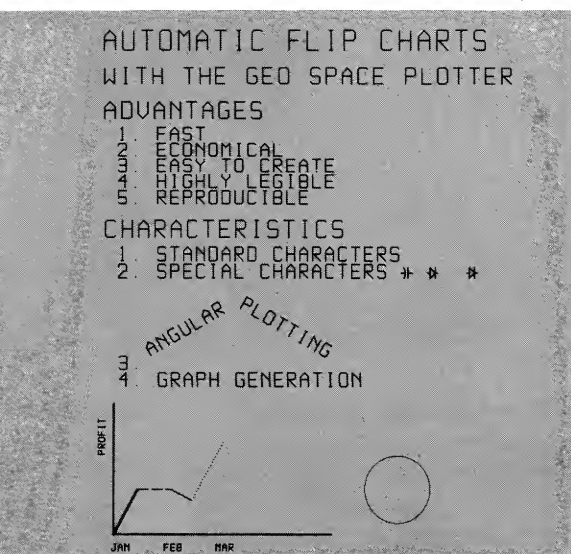
Section of seismic contour map



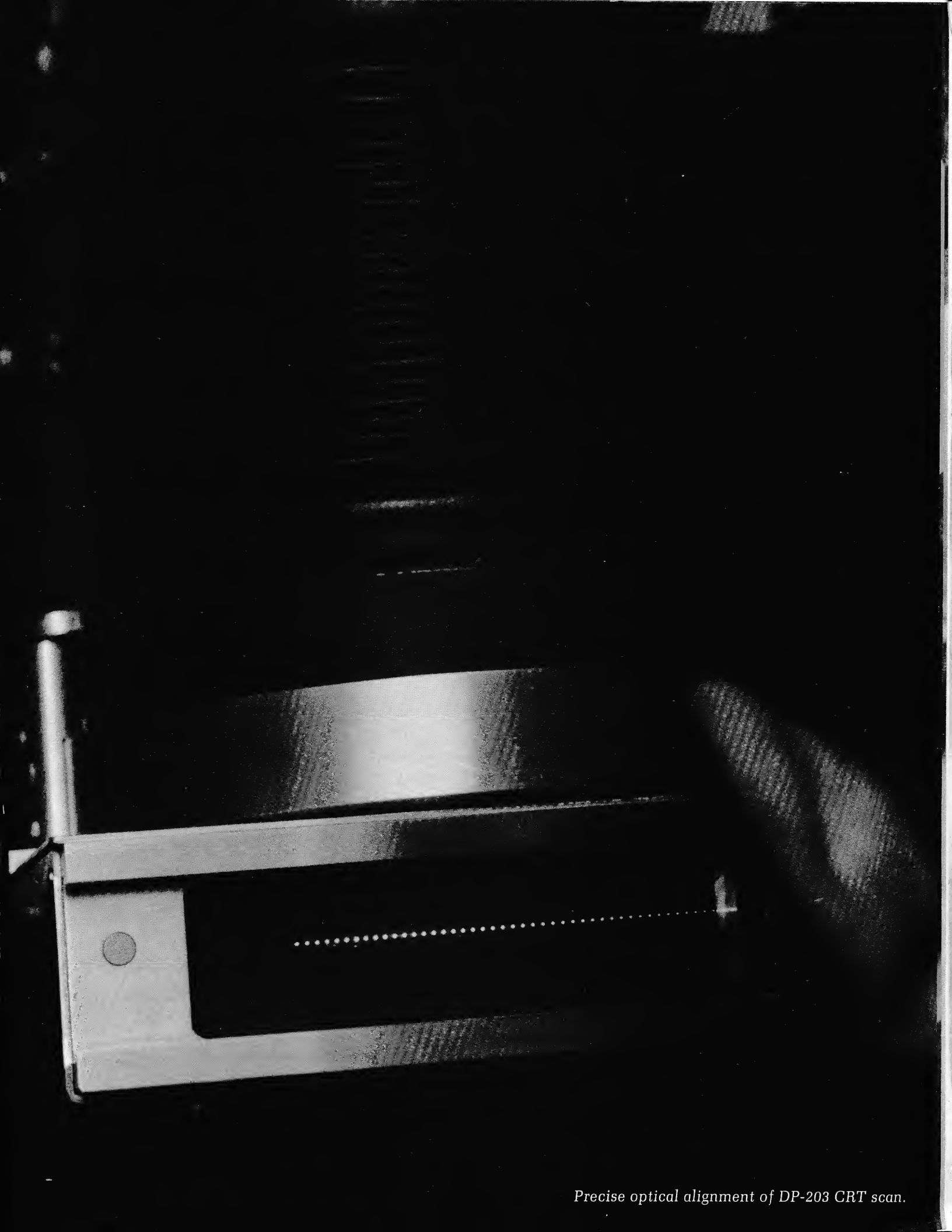
Seismic cross section



Section of integrated circuit mask



Section of automated document page



Precise optical alignment of DP-203 CRT scan.



Manufacturing line of DP-203 Plotters



Verifying quality of seismic cross section produced on the DP-203

USER DOCUMENTATION

The DP-203 Plotter's user documentation is comprised of two comprehensive documents, the DP-203 Operator's Manual and the separate Plate & Schematics section.

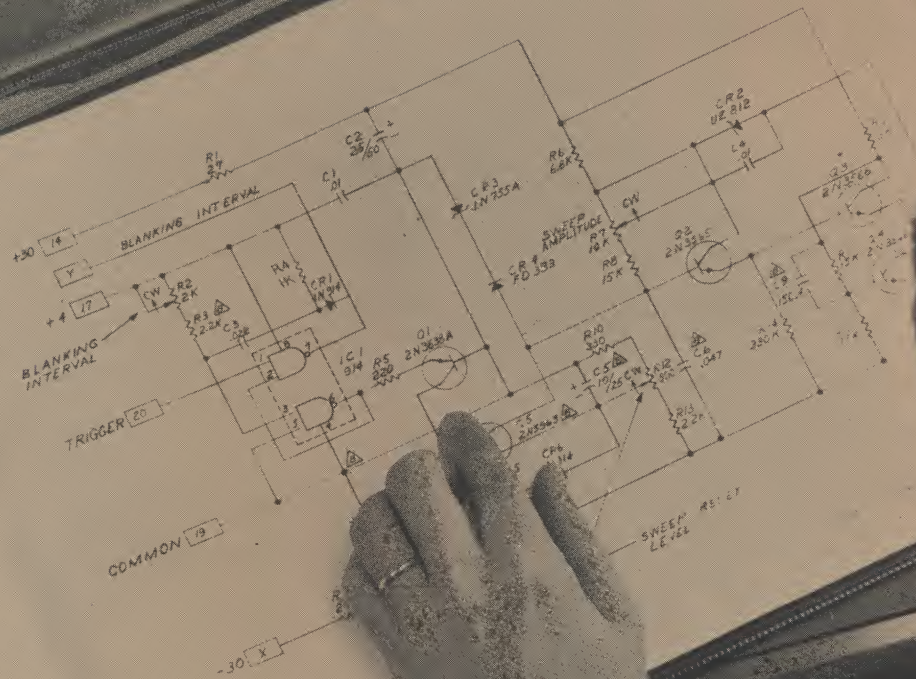
The DP-203 Operator's Manual introduces the user's operation personnel to the basic principles of operation and use of the Plotter. The Plate & Schematics section profusely discusses and illustrates electrical, mechanical components and assemblies.

The Operator's Manual includes expanded information on Physical Features, Electrical Features, Generation of Image and CRT Plot, Electromechanical Assemblies, Logic Theory, Installation, Alignments and Calibration, Operations Procedures, Preventive Maintenance, Trouble Shooting, Spare Parts, Kits and Supplies and Test Equipment.

COMPUTER DIVISION
GEO SPACE CORPORATION

INSTRUCTION MANUAL
GEO SPACE DIGITAL PLOTTER
MODEL GP-200B

COMPUTER DIVISION
GEO SPACE CORPORATION
HOUSTON, TEXAS



SPECIFICATIONS

- Plotting Rate:* 2 usec/bit (500 KC).
- Plotted Area per Minute:* 2000 sq. in. per minute.
- Data Points and Geometry:* 100 by 100 or 200 by 200 data points/sq. in. — 0.010 or 0.005 in. dots.
- Data Point Intensity:* Thirty-two levels from black to white, linear to $\pm 3\%$ best straight line.
- Intensity Stability:* $\pm 5\%$ over twenty-four hour period.*
- Data Point Repeatability:* $\pm 1/2$ bit vertical and horizontal positioning.
- Power Requirements:* 120 volts $\pm 10\%$ at 4 amps, 60 Hz. (50 Hz and other voltages available)
- Physical Dimensions:* 61" L by 61" H by 31" D. Weight: 700 pounds.
- *Calibration:* 15 minute calibration required for 24 hour period.

Interface Models: DP-203A IBM 1130 interface.
DP-203B IBM System 360
(Model 30 and above) and 1800.
DP-203C Control Data
3000/6000 interface.
DP-203D SDS Sigma 2-7 interface.

PLOT-O-MAG CARTRIDGES

Plot-O-Mag disposable film and paper magazines enable operation of the DP-203 in normally illuminated data processing facilities. Each cartridge contains one sheet of a specific size of photosensitive paper or film. Leader and cartridge spool of the Plot-O-Mag cartridges are disposable at processing time. Minimal darkroom facilities and non-critical developing procedures are needed to process Plot-O-Mag photographic media (see *Accessories* for automatic processor.)

Plot-O-Mag recording media utilize photographic paper or film, up to 40 x 60 inches in size. Film base is polyester — dimensionally very stable with outstanding resistance to tearing and mishandling. Film and paper are capable of resolving the full 32 shades of the grey wedge chart exposure possible with the intensity control of the DP-203.

High contrast film media is available for users who plot PC masters, integrated circuit or discrete component semiconductor masks.

<i>Description</i>	<i>Cartridge Type</i>
P23	Paper, 20 x 30 inches
F23	Film, 20 x 30 inches
P46	Paper, 40 x 60 inches
F46	Film, 40 x 60 inches
F23/HC	Film, high contrast, 20 x 30 inches
F46/HC	Film, high contrast, 40 x 60 inches

Special sizes will be furnished upon request.





ACCESSORIES

Continuous Strip CRT Recorder

A unique and useful accessory to the Geo Space DP-203 Plotter. It can be furnished with either a 35 or 70 mm film magazine. It can also be supplied with a dry write paper or film magazine for quick look hardcopy.

Since the strip recorder uses the same format and programming as the DP-203, it can be connected and operated in parallel with the DP-203. The recorder can also be supplied as a stand alone, on-line device.

Monitor Storage Scope

Features a 21" high resolution storage type display scope. Use of the storage tube allows long term viewing without regeneration or additional buffering. The Storage Scope accepts identically formatted data as the DP-203 Plotter, and uses the same software. Images to be plotted on the DP-203 Plotter can be previewed in advance of actual plotting.

The scope can operate as a symbiont device directly from the DP-203 plotter interface electronics. It can also be supplied as a stand alone, on-line device.

IBM System/360 Manual Channel Simulator

Now available to System/360 users as a valuable peripheral design and checkout tool. Designed as an internal checkout System/360 Selector Channel simulator for testing the DP-203 Plotter prior to shipment. It utilizes manual switching for sequencing according to the standard I/O interface procedures.

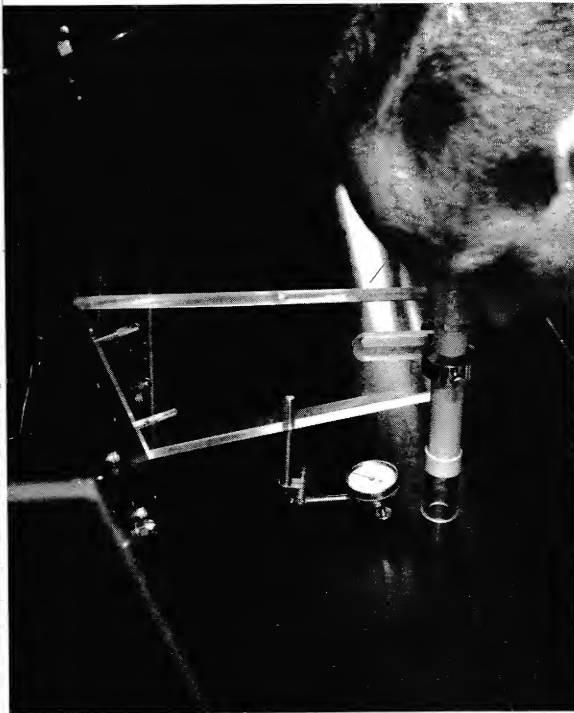
Plot-O-Mag Automatic Developing Processor

High volume production users of the DP-203 Plotter can utilize the Plot-O-Mag Automatic Processor for rapid turnaround processing of Plot-O-Mag cartridges. After insertion of a Plot-O-Mag cartridge into the automatic processor, a dry processed photographic record is delivered within *two minutes*. Darkroom facilities are not required for the Plot-O-Mag Automatic Processor.

CUSTOM INTERFACE DESIGN

Geo Space Computer Division has use-proven digital computer interface designs to IBM System/360, 1130 and 1800 computing systems; SDS Sigma 2-7 series computing systems and Control Data 3000/6000 series computing systems. Perhaps your organization has need for a custom designed interface for a specific I/O utility.

The Engineering staff of Geo Space Computer Division would like to help you solve your interface design and hardware problems. Give us a call defining your problem and we will give you a prompt proposal for the solution.



Calibration of the axial alignment of the drum/CRT optical head

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GEO SPACE



CORPORATION

COMPUTER DIVISION

3009 SOUTH POST OAK ROAD
HOUSTON, TEXAS 77027

22 May 1967

Mr. T. Nelson
Systems Consultant
Box 1546
Poughkeepsie, New York 12603

Dear Mr. Nelson:

Thank you for your request for information regarding Geo Space Computer Division products. We are enclosing a brochure and data sheet which describes the performance characteristics of our DP-203 Digital CRT Plotter and SS-100 Analog Computer.

The DP-203 as a high-speed, on-line plotter, offers the maximum performance available in plotting equipment. The ALPACA software system provides the means by which the image is generated and plotted. The ease of operation of this system coupled with its proven performance standards, clearly makes the DP-203 the plotter to consider.

The SS-100 Analog Computer is designed expressly for linkage with a digital computer for hybrid computation and is a superlative third generation computer. This all solid-state 100 volt system incorporates the most advanced concept in console design, circuitry, operator convenience, flexibility and overall reliability.

We hope this will be of interest to you and should we be able to provide further, more definite information, please do not hesitate to contact us.

Very truly yours,

Kenneth Raybon
Sales Engineer

KR:jo

Enclosure